

AUTO BODY CONSORTIUM (JOINT VENTURE, FORMERLY 2MM AUTO BODY CONSORTIUM)

# A Systems Solution to a Quality Problem in Auto Body Manufacturing

*Just a few millimeters make a big difference on an automated assembly line as doors, hood, windshield, wheel housings, and other parts are installed on a body-in-white (BIW), the partially completed body of an automobile. If BIW openings are slightly off kilter or parts vary much from specifications, the overall fit and finish of the completed car suffers. When dimensions vary more radically, a BIW may have to be custom-assembled by hand. In addition, if the variations grow too large, the entire BIW may be pulled from the assembly line and junked.*

## COMPOSITE PERFORMANCE SCORE

(based on a four star rating)

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### Toward a Tightly Fitted Car Body

In contrast, a tightly fitted car means fewer defects, less time and money for factory repairs, better appearance and performance for the owner, and lower long-term maintenance costs. And the quicker assembly-line changeovers can be made while retaining tightness of fit, the faster new models can be introduced at reasonable cost.

### A U.S. Problem Overcome

The problem of dimensional variation has cost the U.S. automotive industry dearly in product quality, wasted materials, increased production time, and lost sales. While European automakers were building cars with dimensional variations less than 2.5 mm and Japanese manufacturers were achieving results at or below 2 mm, U.S. producers were assembling cars with as much as 5- or 6-mm variation. But with completion of ATP's "2mm Project" in 1995, American automakers have shown a marked increase in their ability to assemble cars with world-class precision. In all five Chrysler and General Motors (GM) auto assembly plants where the new methods were tested, overall dimensional variation was brought down to, or below, the 2 mm standard. In addition, other technologies developed by the project have yet to reach the assembly line, and their full implementation in auto body plants promises to reduce dimensional variation even further.

### Lower Production Costs

With an investment of \$4.9 million from the ATP and \$9 million from the automobile industry, the 2mm Project



Assembly plant staff members monitor operations using real - time analysis tools developed in the ATP project.

developed a number of interrelated technologies and processes that have already cut net production costs (actual costs less the cost of implementing 2mm technologies) by \$10 to \$25 per vehicle in plants where they have been tested. When full adoption by all GM and Chrysler assembly plants is achieved — probably by the year 2000 — annual production cost savings are projected in the range of \$65 million to \$160 million on the current production volume of 6.5 million vehicles, which amounts to 48 percent of the cars and light trucks sold in the United States. Some of the cost savings are likely to be passed on to consumers as a result of competition among U.S. and foreign producers in the

## PROJECT HIGHLIGHTS

### Project:

To develop improved measurement technology and process control needed to achieve tighter fit — as well as better quality and lower costs — in auto bodies and other

**Duration:** 9/1/1992 — 10/31/1995

**ATP Number:** 91-01-0177

### Funding (in thousands):

ATP	\$4,487	43%
Companies	<u>6,048</u>	57%
Total	\$10,535	

### Accomplishments:

The project achieved the R&D goal of developing measurement and process control technology, which participating companies verified in several in-plant tests. Widespread adoption of the technology is now underway in auto assembly plants. Indicative of progress, the companies:

- cut dimensional variation in auto body assembly to a world-class standard of 2 mm or less and demonstrated the reduction with existing workforces in all five plants initially targeted by the project;

- reduced production costs by \$10 to \$25 per vehicle at two plants initially adopting the technology, savings that are expected, according to consortium staff, to be applied eventually in plants which produce all 6.5 million cars and light trucks produced annually by Chrysler and General Motors;

- reduced expected future maintenance costs by an estimated \$50-\$100 per vehicle;

- published several papers in professional journals;

- published *The Capture and Communication of Knowledge: A Lessons-Learned Approach*, a manual that will speed the adoption of the technologies and processes developed during the ATP project by showing how to implement them;

- worked with the University of Michigan to begin transferring the technology to other GM and Chrysler assembly plants beyond the original five, implementing it thus far in 22 plants in the United States and Canada;

- generated via ISI Automation Group (formerly ISI Robotics) the spin-off development of a new type of clamp, called the SofTouch, for holding sheet metal parts during assembly; and

- provided member auto assembly companies a quality peg on which to hang marketing literature — Chrysler highlights the fact that its new Concorde "literally has a two-millimeter body."

### Commercialization Status:

Some supplier companies have incorporated the new measurement and process technology in assembly line equipment, and the new approach to tighter fit has been put into use in 6 of 10 Chrysler plants and 16 of 31 GM plants in the United States and Canada. Net production cost reductions of \$10 to \$25 per vehicle are estimated to have already been achieved using the new approach, meaning millions of dollars saved per year. Higher-quality vehicles from these plants are becoming available to consumers, and U.S. manufacturers are expected to increase their market share.

### Outlook:

Because the technology is being used and being systematically transferred to additional plants, the outlook is excellent. It is now being transferred to all Chrysler and GM plants, and through the supply chain, to Ford Motor Company. The technology is expected also to be adopted or adapted for use by other discrete manufacturers in, for example, the appliance and furniture industries. Auto assembly companies that adopt this new technology can expect to save hundreds of millions of dollars annually in production and maintenance costs. Consumers will benefit from higher-quality vehicles and will likely see some of the manufacturing cost savings. Producers and consumers are expected to benefit from yearly savings of up to \$650 million in auto maintenance costs. Quality improvements resulting from the project have been projected to boost U.S. industrial output by the automotive and related industries by more than \$3 billion in 2000 and to create thousands of new jobs. To the extent the quality improvements extend to other manufacturing industries, the output and employment effects will be even greater.

### Composite Performance Score: \* \* \*

### Company:

Auto Body Consortium  
(joint venture lead; formerly 2mm Auto Body Consortium)  
2901 Hubbard Road  
Ann Arbor, MI 48105

**Contact:** Ernest Vahala

**Phone:** (734) 741-5905

**Joint venture participants:** CDI-Modern Engineering; Classic Design, Inc.; Detroit Center Tool, Inc.; ISI Robotics; Perceptron, Inc.; Pioneer Engineering & Manufacturing; Progressive Tool & Industries, Inc.; Weber Technologies, LLC; Chrysler Corporation; General Motors Corporation (GM), Technical Center; University of Michigan, Mechanical Engineering and Applied Mechanics.

**Subcontractor:** Wayne State University

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*ATP's financial contribution helped small- and medium-supplier companies pay for an expanded university effort while large assemblers provided most of the industry cost share, which covered their own expenses and joint venture overhead.*

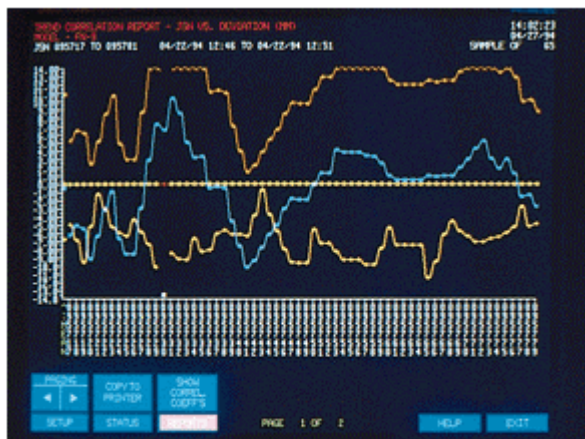
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new vehicle market in the United States.

### Less Maintenance, Faster Launch

Cars and trucks built with 2mm Project innovations should also cost less to maintain as better body fit results in reduced wear, less rust, and fewer other problems. These savings are estimated to range from \$50 to \$100 per vehicle over its useful lifetime. Several years after GM and Chrysler have fully implemented





The computer display for one of the many diagnostic procedures provided by the new dimension control system.

the 2mm Project results, total maintenance savings are expected to reach \$325 million to \$650 million per year based on current production volume. And, although a dollar value has not yet been estimated, the new technology is expected to decrease the time required to launch new auto models.

### Higher Quality and Lower Costs Mean Increased Market Share and Jobs

In addition, assuming the 2mm Project quality and cost improvements lead to at least a one percent increase in market share for GM and Chrysler (at the expense of vehicles built abroad), economic projections show an overall increase in U.S. economic output in 2000 of more than \$3 billion and the creation of around 70,000 new jobs. These estimates take into account the impact of an increase in vehicle sales on related sectors, but they do not include any increases due to adoption of 2mm technologies by companies outside the auto industry.

### Collaborative Research to Solve a Complex Systems Problem

The 2mm Project was initiated by the Auto Body Consortium (eight small- and medium-size companies that provide tooling and engineering services for auto body assembly lines), two big auto manufacturers (Chrysler and General Motors), and two universities, one a joint venture partner, and the other a subcontractor. The joint venture treated BIW dimensional variation as a systems problem, selecting 11 subprojects, or tasks, to be accomplished in four general areas. Separate task groups, with staff from various joint venture members, worked on each subproject. After the operational tasks were completed, the final task of the 2mm Project was to synthesize the information, processes and lessons learned from the research and incorporate the results into a user-friendly database to help companies adopt the new

technologies and methodologies and establish an infrastructure for future improvements.

The 2mm Project would have been difficult to achieve without the involvement of the ATP for several reasons. Dimensional variation in auto body production is a systems problem that could not have been solved by any 1 of the 11 project members alone. The ATP encourages formation of joint ventures like the Auto Body Consortium to solve complex systems problems. The public/private partnership was helpful in the face of a long history of federal antitrust enforcement that has left automakers fearful of cooperating with each other without federal government involvement. Assembly line

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*... organized meetings to share results with interested people from the aerospace, appliance, and metal furniture industries, as well as other industries that use automation to assemble metal parts.*

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suppliers are generally small- or medium-size companies without research budgets large enough to fund work of the type undertaken by the 2mm Project, and automakers have been reluctant to fund research by their suppliers. The fact that development risks were unevenly born by consortium member firms was another obstacle that ATP participation helped to overcome.

ATP's participation in the 2mm Project proved critical to the formation of this research joint venture. The ATP provided the catalyst needed to overcome multiple barriers. ATP's financial contribution helped small- and medium-supplier companies pay for an expanded university effort while large assemblers provided most of the industry cost share, to cover their own expenses and joint venture overhead.

The 2mm Project shows how small- and medium-size supply companies, large auto producers, and universities were able to cooperate in the development of an integrated system to reduce dimensional variation in body assembly and to improve the quality of the final product. It also demonstrates the unique role that comparatively modest investments of money and leadership by ATP can play in catalyzing complex, cooperative research ventures that pay off handsomely in technological and economic returns.

### Widespread Adoption Underway in Auto Plants

The new approach to tighter dimensional fit has been put into use in 6 of 10 Chrysler plants and 16 of 31 GM plants in the United States and Canada, and it is being transferred to the remaining GM and Chrysler plants and to Ford Motor Company through the supplier chain.